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My Experiences with Poplar Species and Hybrids, Particularly the McKee Hybrid Poplar

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My Experiences with Poplar Species and Hybrids, Particularly the McKee Hybrid Poplar [1/]

By

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I decided not to limit my participation in this discussion to the McKee hybrid, but to include other poplar species and hybrids. So, the title of this paper is: "My Experiences with Poplar Species and Hybrids, Particularly the McKee Hybrid Poplar".

Before coming to Ohio, among my duties as a research forester with the Penna. Dept. of Forests & Waters, I supervised an arboretum containing some 650 species and varieties of woody plants, located at Mont Alto, in Franklin County, the South Mountain region of Penn's Woods. This arboretum occupies a well-drained site, on Hagerstown sandy loam soil, at an elevation of 1,000 feet.

Among the poplars we had growing at Mont Alto were 10 outstanding hybrid poplar clones developed by the Oxford Paper Co. of Maine, in cooperation with the New York Botanical Garden. I'm sure most of you are familiar with this project undertaken in the 1930's, on which Ernie Schreiner worked, along with associates, including Ralph McKee, from the Northeastern Forest Expt. Station, headquarters then at Philadelphia but now at Upper Darby, Pennsylvania.

In 1938, I obtained a booklet issued by the N. Y. Botanical Garden, giving the parentage of the Oxford Paper Co. hybrids, from which cuttings were already set out in test plantings, at many locations in the eastern United States, and abroad.

All of them were named clones, including Rumford, Strathglass, Frye, Maine, Geneva, Oxford, Rochester, Androscoggin, Andover, and Roxbury.

1/ Paper given at the winter meeting of the Ohio Chapter, Society of American Foresters, at Beech-Maple Lodge, Blacklick Woods, Columbus, Ohio, Feb. 7, 1964.

2/ Silviculturist, Dept. of Forestry, Ohio Agr. Expt. Station.

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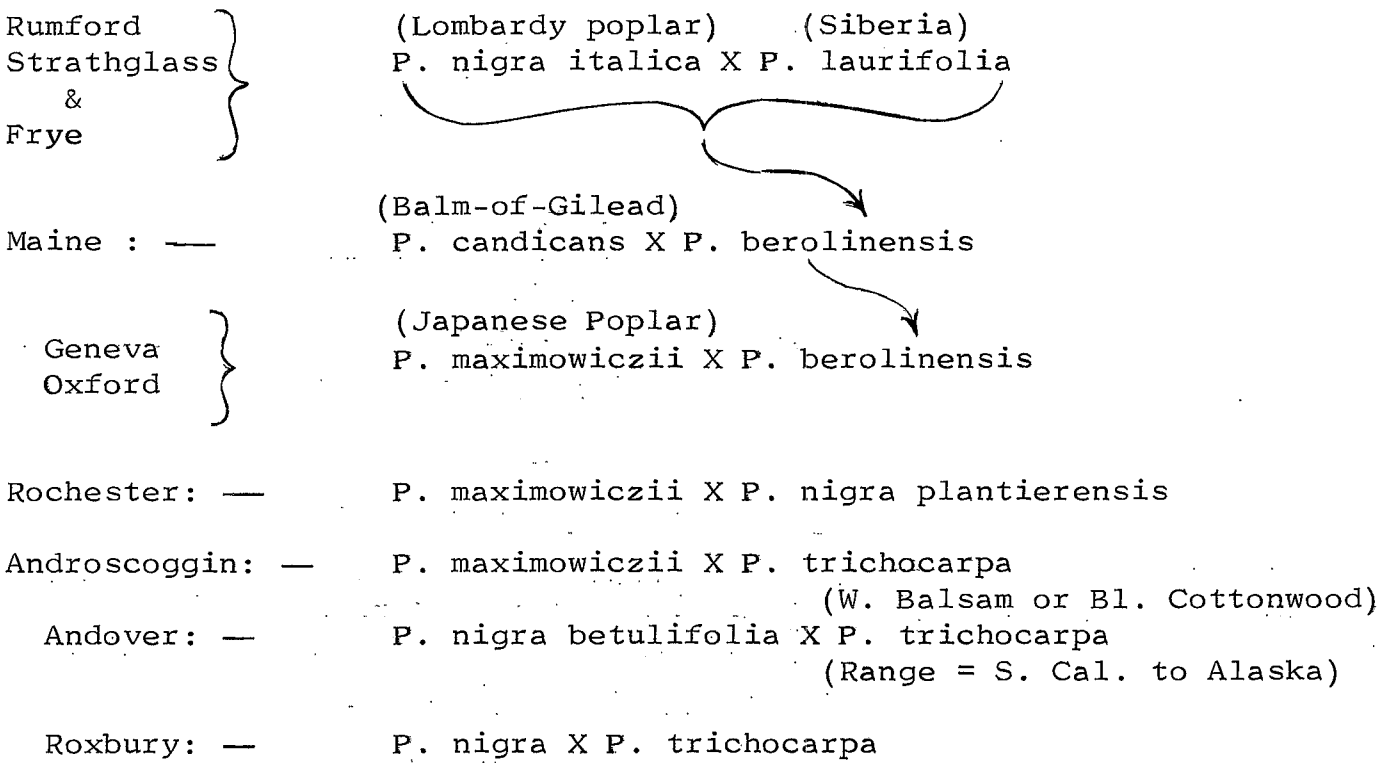
Now let us look at their origin. The 1st 6 have P. berolinensis, a European poplar hybrid, as one parent.



Out of a great many hybrid poplars developed by Ernie Schreiner and his cohorts, these 10 just discussed were considered the most promising. All of them did show phenomenal growth at Mont Alto, but unfortunately they proved so susceptible to trunk cankers that before attaining a 12-inch d.b.h. most of them had succumbed to wind breakage. I did observe, however, that the poplars performing best, both from the standpoint of growth and susceptibility to disease, had Japanese poplar in their parentage. Perhaps their vigorous growth was sufficient to offset the effects of the fungus.

There also was then in the arboretum one specimen of Japanese poplar (P. maximowiczii) obtained via seed exchange with an experiment station in the Orient. This species is native to N.E. Asia and Japan. Dr. Diller and Dr. Kriebel will recall having seen the specimen tree while attending a forestry convention at Mont Alto. That Japanese poplar grew faster than any other tree ever planted there. The records show that at 12 years of age it had a total height of 63 feet and a d.b.h. of 14 inches. When I left Pennsylvania, on Sept. 1, 1956, it was still going strong and, to the best of my knowledge, it carried no serious trunk cankers. Its foliage is of striking appearance; and, unlike that of most poplars, it persists until late in the fall.

Another of the most promising poplars growing at Mont Alto was the Mongolian poplar (P. suaveolens), a tree native to Turkestan, Western China and Korea. Characterized by smooth, grayish-yellow bark, it made very rapid growth and developed little canker injury.

This canker so often present on hybrid poplars is usually Septoria musciva Peck. Let me quote from Waterman's U.S.D.A. Circular No. 947, issued Nov. 1954 3/:

"A serious disease of hybrid poplars in the United States and Canada at the present time is that caused by the fungus Septoria musciva. This is a common leaf-infecting fungus on native poplars, but it produces cankers as well as leaf-spots on some exotic species, and on hybrid poplars, particularly those with black, balsam, and cottonwood parentage. Since the first report of the canker in the United States (Waterman, 1946) and the isolation of the causal organism, a study has been made of the manner in which infection occurs in nature, the action of the fungus upon the hosts, and the relative susceptibility of selected hybrid poplar clones that represent crosses between various species of poplar. The susceptibility rating was based upon the reaction of the hosts following artificial inoculation."

"The immediate occasion for a detailed study of the disease was extensive injury to hybrid poplar clones in plantations in the eastern United States. These clones had been selected from hybrid seedlings obtained by Stout and Schreiner from crosses with 34 poplar species and hybrids".

"Septoria canker has caused extensive losses, particularly in hybrid poplar plantings in Massachusetts, Vermont, New York, Maine, Pennsylvania, Maryland, and in those established by The Tennessee Valley Authority at Norris, Tennessee. It occurs also in plantings made in Wisconsin and Minnesota".

"So far as is known at the present time, species of poplar native in the United States are highly resistant to stem infection by Septoria musciva. However, all native species, and a large number of European and Asiatic species, are susceptible to leaf infection. Therefore, hybrids grown anywhere in the range of our native poplars may prove susceptible to Septoria, as a canker producing fungus".

3/ Waterman, Alma M. 1954. Septoria canker of poplars in the United States. Circular No. 97, U. S. Dept. of Agriculture, Washington, D. C.

"Early in the study it became evident that not all clones of like parentage reacted similarly to infection by artificial inoculation. Some clones would show resistance, whereas others developed conspicuous cankers".

In the tabulation of final results, McKee hybrids were, out of a total of 70 inoculations, 72 percent infected; only 2 of those inoculated showed slight susceptibility, and 8 moderate susceptibility. To gauge the susceptibility rating, retarded infection, due to production of callus tissue, was evaluated. And note, too, this concluding statement: "No clone among those already tested, irrespective of its parentage, can be considered immune".

In 1948, 16 years ago, Paul Rudolph 4/, reporting on hybrid poplar plantings in the Lake States, said: "The hybrid poplars so far planted in the Lake States have given disappointing results in the field. They include the Oxford Paper Co. hybrids, and many others". He said, too, and note this: "In northern Minnesota, the "Henry" poplar looks better than any of the Oxford hybrids".

The "Henry" poplar he referred to is P. generosa which, according to Alfred Rehder, Henry developed in England, in 1912. This is one of those confusing cases in the nomenclature where a hybrid is given specific status, for actually P. generosa is a cross

(Southern Cottonwood)(W. Balsam or Bl. Cottonwood)
between Populus angulata X Populus trichocarpa.
(P. deltoides missouriensis) (Range = S. Cal. to Alaska)

This is where Ralph McKee enters into the picture. After working with Ernie Schreiner on the Oxford Paper Co. project, McKee set up in business for himself, growing improved hybrid poplars for sale. His nursery was, and possibly still is, located at Gansevoort, N.Y. His "Strain F", of the cross between angulata and trichocarpa is known today as the McKee hybrid poplar.

4/ Rudolph, Paul. 1948. Hybrid poplar planting in the Lake States. Station Paper No. 14, Lake States Forest Expt. Station. St. Paul, Minn.

Let us see now what the performance records are for McKee hybrid poplar, at the Ohio Agr. Expt. Station.

Plot L - 11

Our oldest test plot of this McKee hybrid, established the spring of 1947, at 6 x 6 foot spacing, is designated L-11 in the Secrest Arboretum. A small eroded watercourse bisects the plantation. Bordered on three sides by open ground, it is obviously exposed to the full sweep of the wind. The plantation, approximately one-third of an acre, exists on nearly level, moderately drained, alluvial soil, termed Lobdell silt loam.

Unrooted cuttings, obtained from Ralph McKee, were set out on this site. Prior to planting, however, the area had been plowed and disked. It was cultivated periodically the first growing-season, and mowed the 2nd year, to control grass and weeds. No effective thinning, but some experimental pruning, had been done.

Inventories of Plot L-11 were taken at the ages of 6, 7, 10, and 13 years. For summary tables of these tree measurements, I refer you to P. 5 of Research Circular 53 5/, and to P. 62 of "Performance Records of Woody Plants in the Secrest Arboretum 6/".

At 13 yrs. of age, this plantation had yielded 32½ cords per acre, representing a mean annual increment of 225 cu. ft. or exactly 2½ cords. This growth rate exceeds Schreiner's estimate of the mean productivity of France's world-renowned poplar plantings 7/. Compare, too, this McKee poplar yield with what MacDonald reported for cottonwood in Iowa 8/— 50 cords at 15 years — in fully-stocked stands, on Mississippi bottomlands.

5/ Kriebel, H. B., Lowry, G. L., and W. K. Murphey. 1958. Relationship of site conditions to establishment and early growth of McKee hybrid poplar. Research Circular 53. Ohio Agr. Expt. Station, Wooster, Ohio.

6/ Aughanbaugh, J. E., Muckley, H. R., and O. D. Diller. 1958. Performance records of woody plants in the Secrest Arboretum. Forestry Dept. Series, Bul. 41. Ohio Agr. Expt. Station, Wooster, Ohio.

7/ Schreiner, E. J. 1959. Production of poplar timber in Europe and its significance and application in the United States. Agricultural Handbook No. 150. U.S.D.A., Forest Service, Washington, D.C.

8/ MacDonald, G. B. 1924. The growth, returns and uses of planted cottonwood in Iowa. Bul. 223. Agr. Expt. Station, Iowa State College of Agriculture and Mechanic Arts. Ames, Iowa.

The discouraging feature here, however, is that nearly all our poplars carry a few too many trunk or limb cankers.

On Monday of this week, I revisited our McKee poplar plantings at Wooster which, incidentally, are scheduled for reinventory following the 1964 growing-season. The largest tree I noted in L-11 is now, when 17 years old, 11 inches d.b.h., that is, just entering the sawlog-size class. No tree trunks have been broken-off during the past 4 years.

Plot A-4

The next plot, A-4, is approximately 1/10-acre in size. It occupies a well-drained site, having a 10% slope, on Wooster silt loam soil. This planting was done the spring of 1949, and by using unrooted cuttings taken from Plot L-11. Site preparation, cultivation, and mowing, duplicated the procedure given before on L-11. To date, it has been thinned twice, each time lightly from below.

Many, but not all, of these poplars are cankered; a few have broken off, some appear to have outgrown the cankers, and others apparently healed them over. Height and diameter growth, at 4, 5, and 6 years, have exceeded that recorded in Plot L-11. When only 6 years old, the mean diameter was 4.5 inches (maximum 8.1), the mean height 37 feet (maximum 47). And this week I noted, following 15 growing-seasons, a number of 12- and 13-inch trees. Altogether, this record is one of considerable promise, at least to pulpwood growers.

Plot M-1

Area M-1 represents a bottomland site, alongside an intermittent brook, where McKee hybrids were planted the spring of 1951. Formerly a pasture, the ground was then over-run with brambles and weeds. It makes, presumably, a good poplar site; i.e. low ground, moist but not marshy throughout the year. The soil is classed as imperfectly drained Lobdell silt loam, having a one percent slope.

Five acres were planted here to McKee hybrid poplar, at a spacing of 8 x 8 feet. Unrooted 12-inch cuttings were set, with a mechanical tree planter, to a depth of 10 inches, in plowed ground. Initial survival was approximately 80 percent. Fail spots were not replanted.

These hybrid poplars exhibit very few cankers, and those formerly in evidence seem to have disappeared. Callus tissue eventually heals over the exposed wood; at least it retards, or prevents, the spread of the fungus. Frost-crack injury, at the tree bases, however, is rather common, resulting from our severe winters of recent years.

1956-57 Disking & Fertilizing: During the spring of 1956, an experiment had been initiated to test the effects of disking and fertilizing. Of an exploratory nature, it merely was another step towards obtaining the maximum production from the planted poplars, if managed at an intensity level comparable to that given to field crops.

In this experiment, 5 rows of planted trees had been disked, 5 disked and fertilized, and 5 left untreated, which, after 3 replications, made 9 consecutive blocks containing 45 rows in all. Fertilization rate was 1,000 pounds of 4-16-8 to the acre, sowed with a drill and disked into the soil, which treatment was repeated the spring of 1957. This entire plantation had been disked twice during each of its first two growing-seasons (1951 & 1952).

Height and diameter measurements of the 494 poplar survivors were taken in August 1959. Table 2, Circular 79 9/, indicates that the differences in growth response between treatments, after 4 growing-seasons, were slight. We have no explanation to offer for this, inasmuch as fertilization of poplars at the S.E. Substation did yield results of significance.

1959 Silvicultural Treatments: During August 1959, five 1/10-acre sample plots were installed in this stand. Two plots were thinned on a pulpwood management basis, two were treated for an eventual yield of lumber or veneer, and the 5th was left as a control. Table 3, Circular 79, presents a summary of this experiment to date.

9/ Aughanbaugh, John. Dec. 1959. Poplar culture studies at the Ohio Agr. Expt. Station. Research Circular 79. Ohio Agr. Expt. Station, Wooster, Ohio.

In thinning for pulpwood, none but the poplars of merchantable size were harvested. Our cut comprised 8.3 cords per acre on Plot 1, and 7.3 cords per acre on Plot 4. After being bucked into 5-foot lengths to a minimum top diameter of 4 inches, this pulpwood was sold to a local buyer.

With lumber or veneer as the objective, the largest and best poplars were left. There remained 170 and 220 selected trees to the acre on Plots 5 and 2 respectively. A later thinning, following crown closure, should reduce this stand to 125 to 175 poplars per acre on a 35-year rotation.

Every potential crop tree was pruned to 17 feet above ground, and banded with white paint, and numbered. Feathering, or water sprouting from adventitious buds has not, up to now, progressed to any great extent.

Tree measurements, taken at the ages of 3, 4, 5, 6, 7, and 9 years, are reported in "Performance Records of Woody Plants in the Secrest Arboretum". Today, at 13 years of age, some of those poplars are 9 inches in diameter breast-high. I judge this particular planting to be the most promising of our McKee hybrid poplars growing at Wooster.

The S. E. Substation

Area 4 was planted in 1952, at the Southeast Substation, near Carpenter, in Meigs County, Ohio. The spacing is 9 x 9 feet, and the area was disked periodically during the first growing-season. The soil type is Moshannon silt loam, on a one percent slope, and is recent alluvium. A very poorly drained site, it has been flooded several times annually, since the stand was planted. Growth has been comparatively poor due, presumably, to poor drainage. Tree height measurements, taken at 3, 4, 5, and 6 years of age, are reported on P. 6, Circular 53.

When 4 years old, replicated blocks of these poplars were fertilized, using 1,000 lbs. of 8-24-12 to the acre [10/]. Fertilization was repeated the following spring, March 1957, with 4-16-8, and at a heavier rate — 1,333 pounds per acre.

10/ Aughanbaugh, John and William Mitchell. 1963. Results show poplar fertilization improves growth. Ohio Farm & Home Research. July-August issue.

After an elapse of 7 growing seasons, at 11 years of age, fertilization had given these mean percent growth increases: in diameter 20.5% more, height 23.3% more, and volume 67.5% more than on the untreated poplars.

The proportion of fertilized trees bearing trunk cankers, however, is 50.4 percent, as against 28.8 percent in the control blocks. Analysis of variance showed little correlation between tree-size and incidence of trunk cankers. Practically all poplars in the plantation carry numerous limb or twig cankers. Those heavily infected may succumb to disease, or to storm breakage.

Pulpwood growers could benefit from these findings, should the poplar rotation be shortened by fertilization. But, the growth stimulus might, on the other hand, be short-lived, and frequent fertilizer applications too expensive to justify. Expenditures, to date, for fertilizer, have averaged 14¢ per tree.

Conclusion

In conclusion, I might say that our best results with the McKee hybrid poplar were due to these practices: (1) complete plowing and fitting of the soil, (2) planting in good loamy ground, moist but well-drained, and (3) cultivation during the first year or two. Sod and rank weeds have an inhibiting effect on the establishment of poplar. Intolerance of shade precludes its chances to thrive under overtopping vegetation.

I personally think more research ought to be done to develop elite strains of our native cottonwood. It has been my observation that Populus deltoides rarely exhibits any serious trunk cankers. It should be an excellent tree to plant on bottomland sites in Ohio. Cottonwood yields not only pulpwood, but lumber of good quality, and it makes very rapid growth.

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